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E46 FL

Subject **Page**

Initial Print Date:01/03 Revision Date:

Model: E46 Coupe/Convertible

Production: Start of Production March 2003

Objectives:

After completion of this module you should be able to:

- Recognize the update exterior of the Coupe/Convertible.
- Relate the updates and changes to SULEV equipped vehicles.
- Understand the electrical improvements to mirror and lighting systems.
- Know the operation of the LIN Bus.

E46 FaceLift Coupe/Convertible

E46 Coupe and Convertibles (E46/2, E46/C) will receive a facelift effective March 2003.

The front headlights, kidney grills, bumper, turn signals and hood have been revised.

The rear bumper and taillights have been revised.

New front facia with wider kidney grills, reshaped headlights and turn signals, and new fog light openings.

New rear bumper with new reflectors and LED taillight assemblies.

New LED taillight assemblies accent the new rear facia.

Keys

Beginning with production March 2003 all E46 Models will ***not*** be supplied with the grey workshop key. The purse key replaces the function of the workshop key.

IHKA

The location of the operating buttons on the IHKA control unit has been changed. The functionality remains the same.

Drive Train

Engines

SULEV

M56 SULEV (SuperUltraLowEmissionVehicle) is available on a limited (by state) basis in the E46/2, E46/3 and E46/4.
SULEV models (E46 sedan, coupe and sportwagon all with automatic only) will be sold in California, New York and Massachusetts as 2003 models and in Vermont starting in 2004 model year.

In addition these vehicles are certified as PZEV (Partial Zero Emissions Vehicles).

PZEV regulations include:

- Vehicles must meet SULEV tailpipe emissions standard (approx. 1/5 of ULEV standards)
- Vehicles conform to Zero Evaporative Emissions
- Vehicles subject to extended OBD regulations.
- Emission relevant components warrantied for 15 years or 150,000 miles

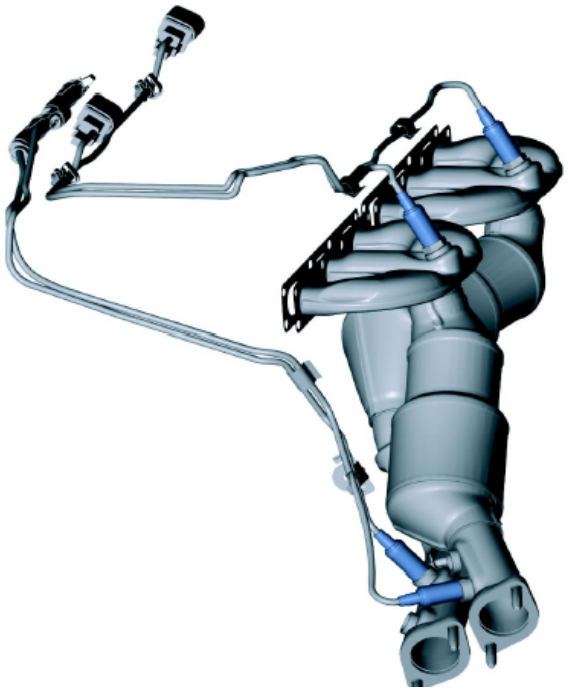
M56 Engine

The following components are used to achieve SULEV and Zero Evaporative Emission requirements:

- Pistons Revised to change spark travel path
- Catalytic Converters Ceramic carriers with high cell density for better “Warm Up” Control
- Oxygen Sensors Planar wide band O2 sensors in front of the cats
- Vanos Positioning changed during start up for improved start up and emissions
- Fuel Pump Control Revised with raised pressure and more accurate flow control
- Fuel Injectors New design for improved fuel flow and higher working pressure
- Fuel System All metal fuel system components made of stainless steel
- Air Intake System Revised to block HC escape
- Crankcase Ventilation Revised
- Secondary Air System Mass air flow sensor to monitor secondary air flow
- Cooling System Revised to reduce Ozone levels

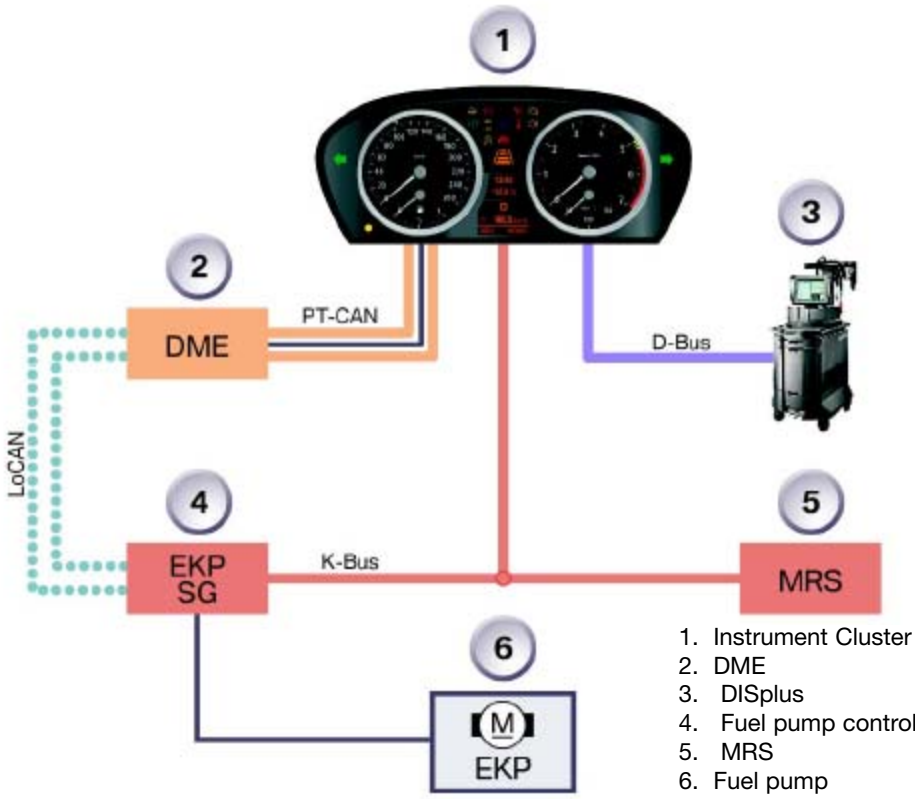
Catalytic Converters

The catalysts attached in direct proximity to the engine and are equipped with ceramic(s) carriers in high cell density technology. These converters reach operating temperature faster and offer quicker control of exhaust emissions. Vehicles are also equipped with dual down-stream converters.



Oxygen Sensors

The M56 engine uses four Oxygen sensors, two planar broadband sensors upstream of the converter and two sensors downstream.
The planar broadband sensor reach operating temperature very fast and are able to effect fuel mixtures in approximately 5 seconds.



1. Instrument Cluster
2. DME
3. DISplus
4. Fuel pump control unit
5. MRS
6. Fuel pump

11402

Fuel Pump System

Fuel system operating pressure is increased to 5 Bar.

The fuel pump is controlled by the Fuel pump control unit, based on engine demand as received from the DME over the Lo-CAN. The fuel pump control unit additionally receives information over the K-Bus, specifically crash information from the MRS.

Fuel Injectors

Nozzle diameter of the fuel injectors has been reduced and the installation angle has been changed. The injectors were also adapted to perform at the higher system operating pressure.

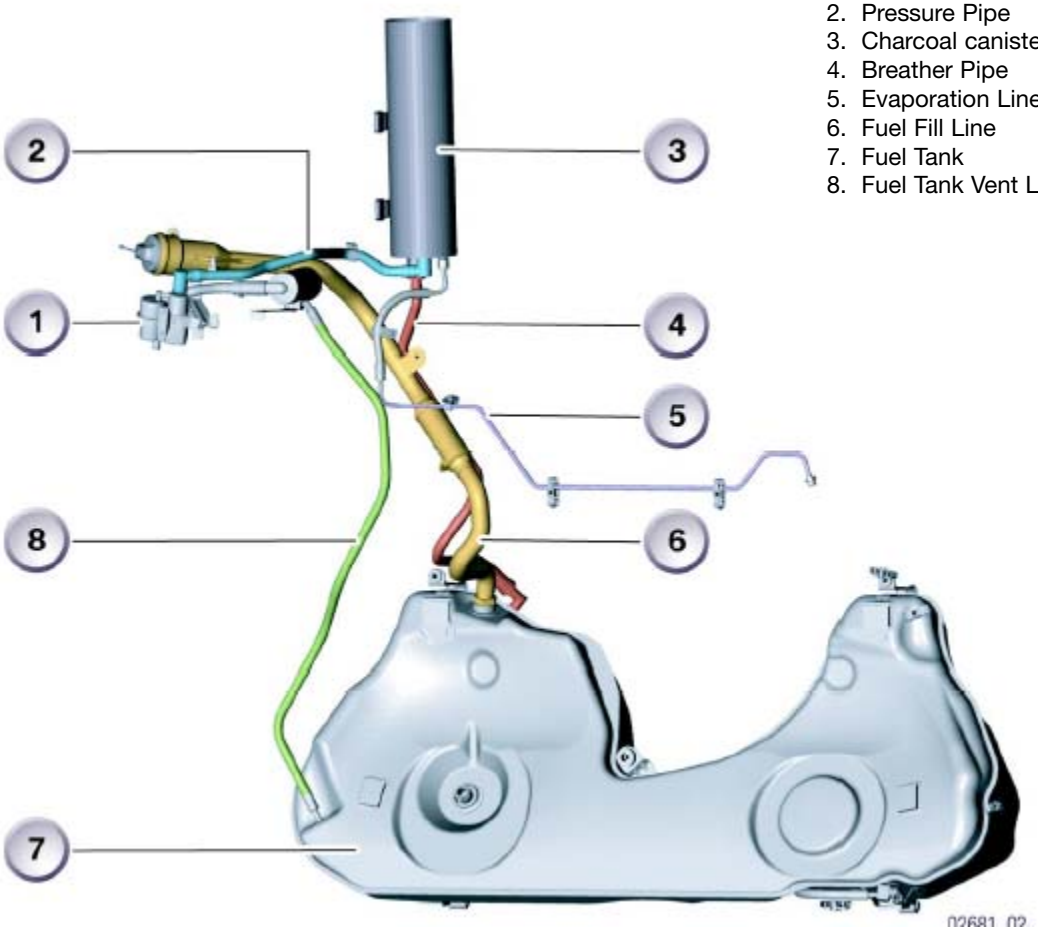
Injectors screw into the rail and a tap to test pressure readings is **NOT** provided.

Secondary air system

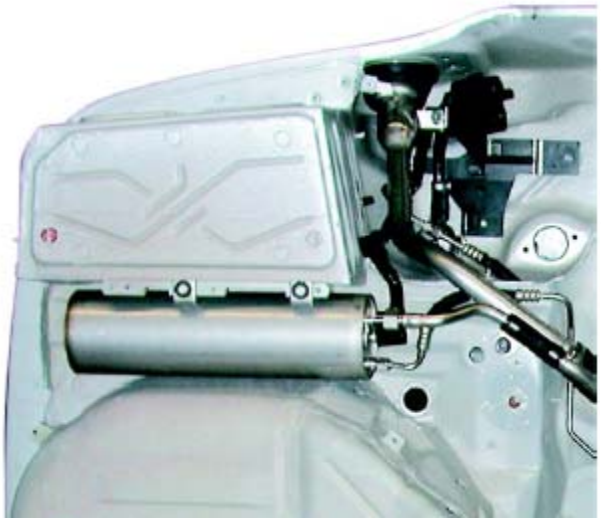
The secondary air pump has been revised to improve its response time in cold weather starting situations.
A HFM (Hot Film Air Mass Meter) has been added to the secondary air system to monitor air volume pumped into the exhaust for more accurate control of the NOx emissions.

Fuel system

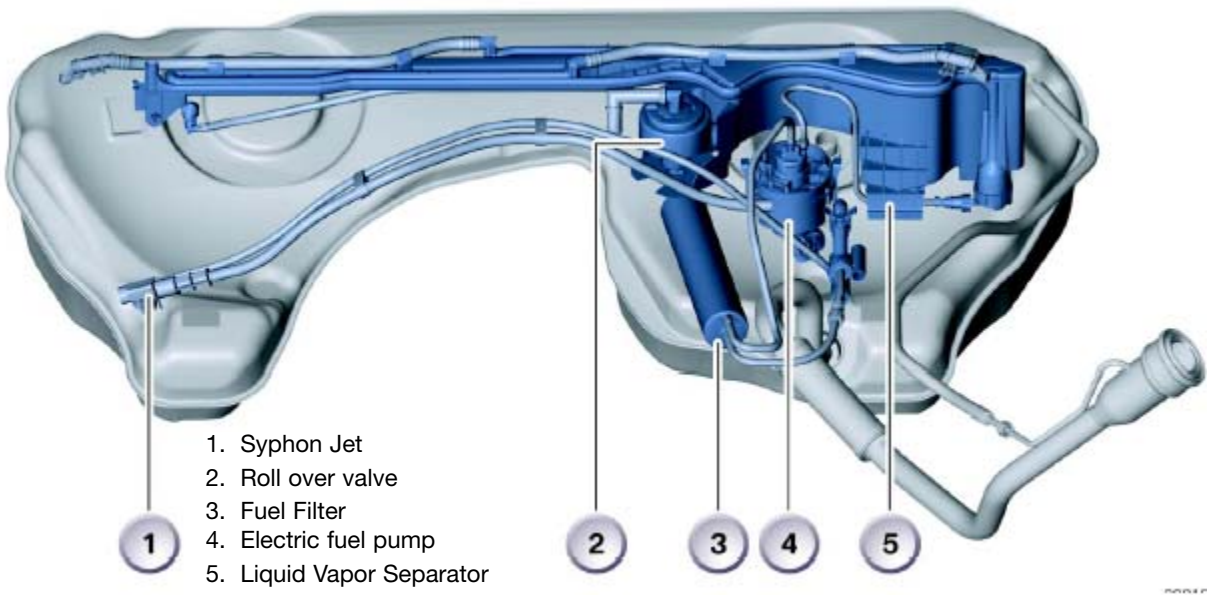
1. DMTL
2. Pressure Pipe
3. Charcoal canister
4. Breather Pipe
5. Evaporation Line
6. Fuel Fill Line
7. Fuel Tank
8. Fuel Tank Vent Line



In order to meet the Zero Evaporative Emission requirement, the fuel system was completely revised. The fuel tank, tank filler neck, charcoal canister, fuel rail and tank ventilation valve are all made of stainless steel.
When perform repairs on the fuel system, it is imperative that all fitting remain clean and that the proper tightening torques are observed.

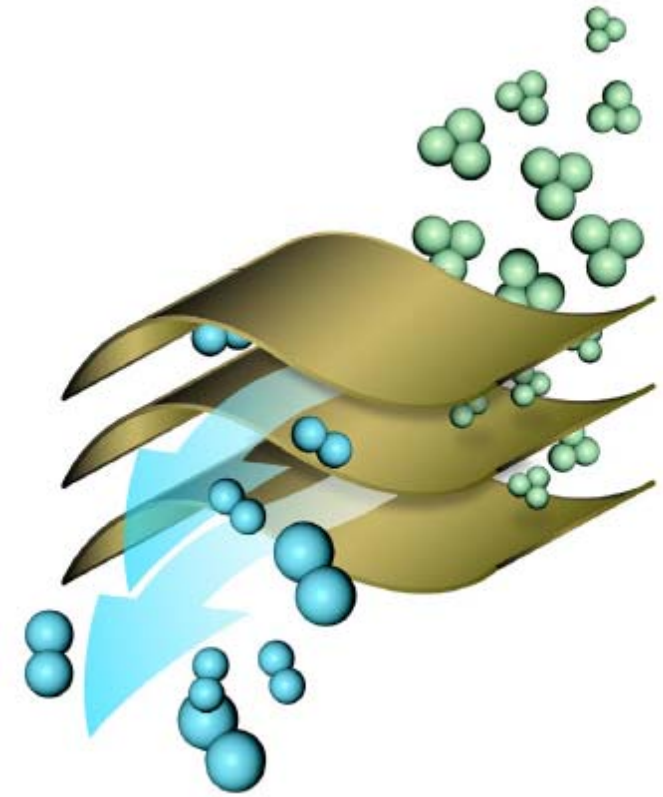


The fuel tank is manufactured of high grade steel and completely coated to meet the requirements of a minimum durability of 15 years.
The fuel tank can be exchanged only as a complete unit.



1. Syphon Jet
2. Roll over valve
3. Fuel Filter
4. Electric fuel pump
5. Liquid Vapor Separator

Cooling System



The radiator of the E46 SULEV looks similiar to the standard E46 radiator.
The surface of the cooling fins are coated with a special “PremAir” coating.
The coating consists of multiple porous layers of a catalytic surface. The task of the catalyst coating is to convert Ozone into Oxygen.

Transmission

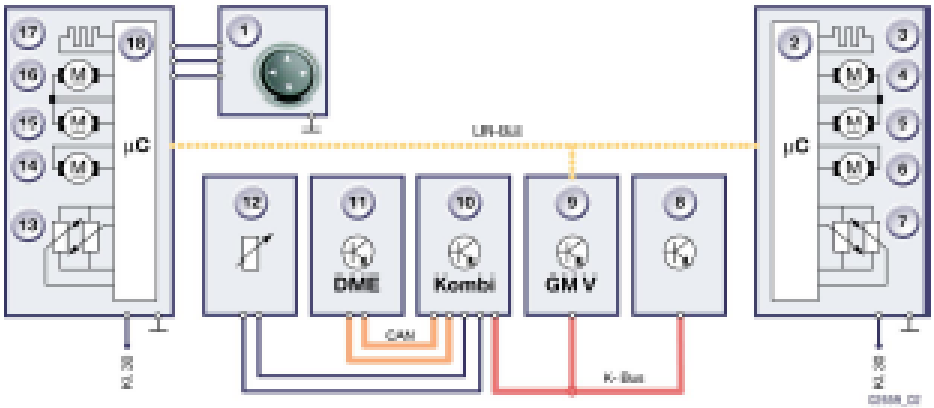
New 6 speed manual transmissions will soon be available for all E46 models except the xi. The 6 speed will be available as the H-SMG as well. Refer to the E85 Training Manual for more information.

General vehicle electronics

Outside Mirror Control E46/3/4

Beginning with production March 2003 the E46/3/4 will be equipped with a new outside mirror control system.

The GM will store the mirror memory position and access the position either through seat memory switches or car key memory.



1. Mirror Switch
2. Mirror Electronics on Right Mirror
3. R/S Mirror Heating
4. R/S Horizontal Motor
5. R/S Vertical Motor
6. R/S Folding Motor
7. R/S Potentiometers
8. Seat Memory Controller
9. GM
10. Instrument Cluster
11. DME
12. Outside temp sensor
13. L/S Potentiometers
14. L/S Folding Motor
15. L/S Vertical Motor
16. L/S Horizontal Motor
17. L/S Mirror Heating
18. L/S Mirror Electronics

The motion control of the mirrors is by the mirror electronics located in the mirror motor assemblies. Mirror position is monitored by potentiometers and passed on to the GM via the LIN Bus. (See LIN Bus explanation)
The mirror switch passes all requests for movement over the LIN Bus to the GM which then sends command signal to the mirror electronics, again via the LIN Bus.
All mirror functions including mirror heating and automatic folding are also controlled by the GM.

Mirror System Components

The mirror system consists of the following components:

- Left and Right Mirror Assemblies -with integrated drive motors, potentiometers and heating elements
- Mirror Switch Assembly
- Flat band wiring harness

Mirror Operation

All decisions regarding mirror function and movement are made by the GM and passed on to the mirror electronics for execution.
Mirror position is monitored by the GM via LIN Bus information from the potentiometers.
Tilt function when in reverse of the passenger mirror is the same as on previous E46 models.

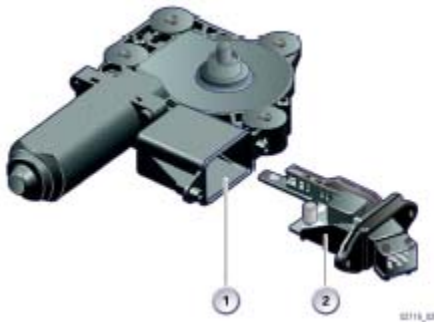
Mirror heating is controlled by the GM based on information received from the outside temp sensor.

In all mirror operations the GM is the master control module and the mirror electronics are the secondary modules.

Windows

Anti-trap Protection

Beginning production March 2003 the E46 M3/C and beginning September 2003 E46C, front windows will be equipped with anti-trap protection.
A new electric window motor has been developed that includes evaluation electronics to monitor window operation and provide “indirect trapping protection.”

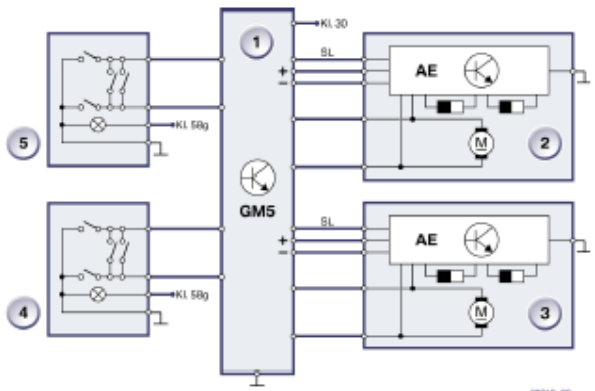


1. Window Motor
2. Window Motor Evaluation Electronics

The Evaluation Electronics monitor the number of
revolutions of the motor, the direction of rotation, and the position of the motor.

The GM is responsible for controlling window operation.

Window movement requests as input into the window switches is processed by the GM and based on information received from the evaluation circuit the window is operating.



1. GM
2. R/S Window Motor
3. L/S Window Motor
4. R/S Window Switch
5. L/S Window Switch

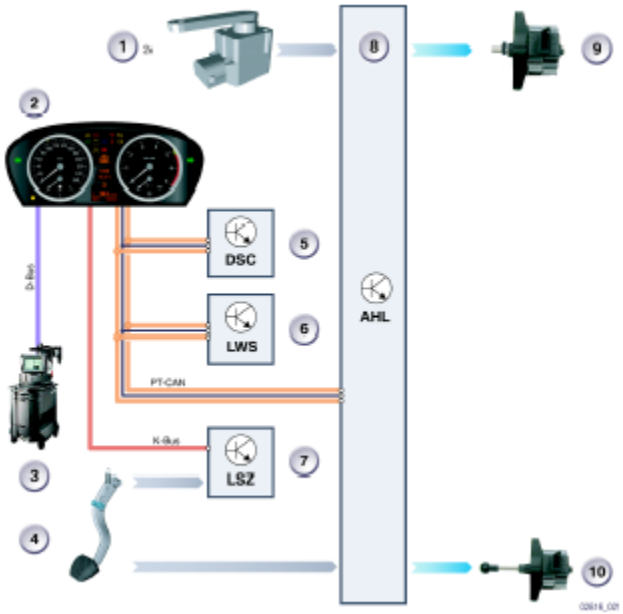
Two sensors integrated in the window motor assembly provide speed, direction and position information to the evaluation electronics, which shares this with the GM.
The GM monitors the current spikes at the beginning point and closing point of window operation as well as amperage during window operation. A sudden rise in amperage and slow down of window speed before reaching the closing point, signals the GM that the window is obstructed and power is cut to the window motor.

The windows do include a panic mode so that if the switch is activated a second time the window is driven with full power until the switch is released.

The windows must be initialized after repair work to the window system or GM.

AHL

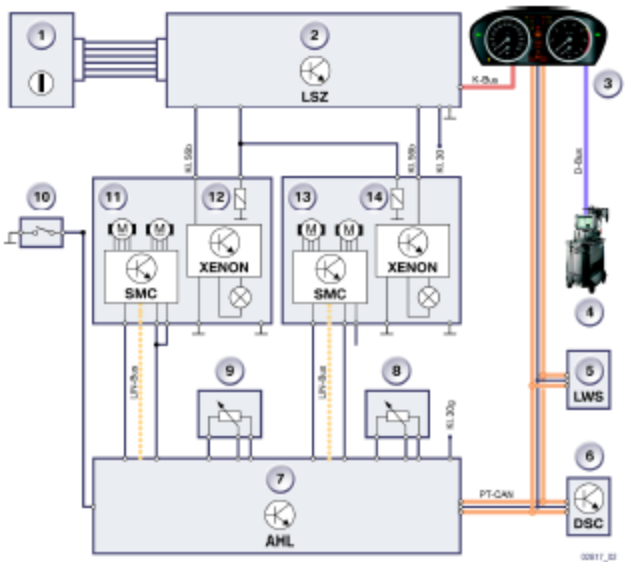
E46 2/C produced after March 2003 may be equipped with AHL (Active Headlight Control). AHL will be coupled with Bi-Xenon Lights only.
AHL provides movement of the headlights in the vertical plane to improve the view for the driver in darkness.



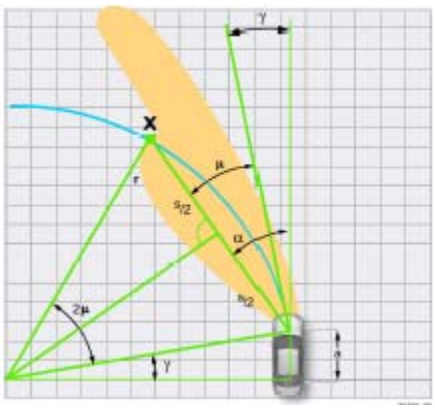
1. Ride Level Sensors (Front and Rear)
2. Instrument Cluster
3. DISplus
4. Brake Light Switch
5. DSC
6. Steering Angle Sensor
7. LSZ
8. AHL Control Unit
9. Stepper Motor for Vertical Movement R/S
10. Stepper Motor for Vertical Movement L/S
Shining width adjustment

The AHL control unit decides based on input from the ride level sensor, steering angle sensor, brake light switch and other data provided by the DSC the speed and direction that the headlights are pivoted.

AHL now controls the horizontal movement of the headlights also.



1. Light Switch
2. LSZ
3. Instrument Cluster
4. DISplus
5. Steering Angle Sensor
6. DSC
7. AHL Control Unit
8. Rear Ride Height Sensor
9. Front Ride Height Sensor
10. Brake Light Switch
11. L/S Headlight Assembly
12. Bi-Xenon Assembly
13. R/S Headlight Assembly
14. Bi-Xenon Assembly



Each headlight assembly contains two stepper motors for headlight movement. One for horizontal movement and one for vertical movement.

Based on processed information the AHL adjust the horizontal position of the headlight to compensate for load changes or swivels the headlights to provide more road illumination in a turn.

The swiveling range of the headlights is 7^0 for the the light closer to the inside of the curve and 15^0 for the outside light.

Brake Force Display

E46 2/C models equipped with LED tail lights also include the Brake Force Display function.

A. Taillight operation
B. Normal Stop Light operation
C. Brake Force Display operation

LIN Bus

April 5, 2000. . . BMW AG, several other car manufacturers, the communications specialist Volcano Communications Technologies AB, and the semiconductor manufacturer Motorola announced the formation of an industry consortium with the objective to define and implement an open standard for class-A serial buses in vehicle networks. The standard has been named Local Interconnect Network (LIN) and will be the enabling factor for the implementation of a hierarchical vehicle network in order to gain further quality enhancement and cost reduction of vehicles. The standardization will reduce the manifold of existing low-end multiplex solutions and will cut the cost of development, production, service, and logistics in vehicle electronics.

Typical applications for the LIN bus are assembly units such as doors, steering wheel, seats, climate regulation, lighting, rain sensor, or alternator. In these units the cost sensitive nature of LIN enables the introduction of mechatronic elements such as smart sensors, actuators, or illumination. They can be easily connected to the car network and become accessible to all types of diagnostics and services. The commonly used analog coding of signals will be replaced by digital signals, leading to an optimized wiring harness.

The increasing software complexity of today's distributed electrical systems represents a major challenge for car manufacturers in terms of design, implementation and maintenance of these systems during the lifecycle of a car project. Provision for highly automated tools addressing the needs of this process are essential in order to ensure efficiency, high quality and short lead-times.

For this very reason - as an industry first - the LIN specification covers not only the protocol definition itself, but also the standardization of tool and application programming interfaces. The introduction of LIN is accompanied by a holistic chain of tools supporting the car manufacturer in all phases of the development project.

The goal of LIN is to define a communication standard below the level of CAN - the major standard in vehicle networking. With respect to cost and performance, LIN is complementing CAN but not competing with it. LIN targets low end applications where the communication cost per node must be two to three times lower when compared to CAN and where the performance, bandwidth, and complexity of CAN is not required.

The communication protocol is based on the common serial ISO 9141 NRZ transmission. It is a single-master/multiple secondary protocol, transmitted via a single-wire bus powered by the 12V car battery. The concept of message identification allows a multi-cast data transmission between any network node controlled by the master. A particular feature of LIN is the incorporation of a synchronization mechanism for slave nodes so that - unlike CAN - a crystal resonator is not required. This enables the application of true single-chip solutions for low cost mechatronics.

The LIN standard includes the specification of the transmission protocol, the transmission medium, the interface between development tools, and the interfaces for software programming. LIN guarantees the interoperability of network nodes from the viewpoint of hardware and software, and a predictable EMC behavior. It is not exclusively defined for automotive applications and is expected to be also successfully applied to industrial or white-good electronics. A wide portfolio of semiconductor and software products is already available for first LIN implementations.

The LIN Bus is a standardized, serial single wire bus transferring data at a speed of 19.2 kBd. (Some LIN Busses may operate at slightly different speeds.)

The LIN Bus is very similiar to the M-Bus normally found on climate control systems.

The LIN Bus (Busses) are diagnosible with the DISplus.

Vehicles may have more than one LIN Bus that are not interconnected (i.e. mirror system bus, AHL motor control bus, etc.)